Use of Epidural Analgesia for Labour and Delivery in Alberta

Technical Report

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Summary of "Use of Epidural Analgesia for Maternal Labour and Delivery in Alberta"

By C. Truman, Y. Jin, and D. Johnson

Purpose

To describe the provincial use of epidural analgesia to relieve maternal pain for obstetrical labor during vaginal deliveries

Approach

Using Alberta Health and Wellness physician claims, hospital abstracts, vital statistic birth registrations and the Health Care Insurance Registry, the use of epidural analgesia was compared for the time period April1, 1997 to March 31, 2000. The influence of hospital organizational factors (physician specialty providing the service, number of yearly deliveries per hospital) upon the use of epidural analgesia is explored.

Key findings

There were 90,991 vaginal deliveries in Alberta during April 1, 1997 to March 31, 2000. Of these, the following are the key findings:

- Epidural analgesia was used during labor in thirty percent of vaginal deliveries in Alberta. This rate is similar to other industrialized countries (Australia, France, United States of America).
- In small, rural hospitals (delivering up to ninety-nine newborns per year), epidural analgesia is used in three to four percent of vaginal deliveries.
- In specialized neonatal care centres in Edmonton and Calgary hospitals, the use of epidural analgesia increases to forty-five percent of vaginal deliveries.
- The chance of receiving epidural analgesia during labor for vaginal delivery is twenty-five times greater comparing the largest to smallest Alberta hospitals after controlling for other factors (previous live births, newborn birth weight, newborn prematurity, newborn breech presentation, and maternal reproductive system comorbidity).
- In hospitals that performed between 100 to 405 deliveries annually, most epidural procedures for vaginal delivery are provided by general practice physicians.
- In regional and metropolitan area hospitals, anaesthesiologist specialists provide most epidural procedures for vaginal deliveries.
- The use of epidural procedures in the larger, rural hospitals (nine percent of vaginal deliveries) and regional centers (ten percent of vaginal deliveries) was similar. General practice physicians predominantly perform the procedure in the larger, rural hospitals and anaesthesiologist specialists perform the service in regional centers.

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Conclusions

A stark rural and urban geographical division exists in the use of epidural analgesia in Alberta. The use of epidural analgesia in the larger, rural hospitals and regional centers was similar despite the difference in the physician who predominantly performs the service (anaesthesiologist or general practitioner).

Greater use of epidural analgesia may be considered beneficial as it affords superior obstetrical pain relief. However, greater use of epidural analgesia is often associated with medicalization of childbirth as epidurals have associated risks.

This study concludes that hospital organizational factors are influential in determining the use of epidural analgesia during labor for vaginal delivery.

For more information

Copies of the report are available from the **Alberta Centre for Health Services Utilization Research**

- by contacting David Johnson by e-mail at cujecjohnson@shaw.ca
- at http://www.health.gov.ab.ca/system/key/Research/achsur_reports.html

Alberta Centre for Health Services Utilization Research

The Alberta Centre for Health Services Utilization Research is a joint initiative between the University of Alberta and the University of Calgary, funded by Alberta Health and Wellness. The Centre conducts studies of how health services are used and delivered to inform health policy development and management of health services delivery.

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TABLE OF CONTENTS

Summary 1
Introduction 2
Methods 2
Defining facility size and service region 4
Statistics 5
Models included the following influencing factor 5
Results 5
Discussion 6
Limitations 8
Table 1 – Number and Percent of Deliveries in Which the Patient Received Epidural Anaesthesia by Facility Type during 1997/98-1999/00 9
Table 2 – Volume of Epidural Anaesthesia by Physician Group During 1997/98-1999/00 for Vaginal Deliveries During Labour 10
Table 3 – Number of Epidurals During Labour for Vaginal Delivery by Facility and Provider Type During 1997/98-1999/00 10
Table 4 – Modeling the Use of Epidurals During Labour for Vaginal Delivery by Facility Size Controlling for Other Influencing Factors 11
References 12
Appendix 14
Table: Epidurals During Labour for Vaginal Deliveries in Alberta Regional Health Authorities During April 1, 1997 to March 31, 2000 by Location Of Service 14
Biographies 15
Corrine Truman, R.N., Ph.D. 15
Yan Jin, M.A. 16
David Johnson, M.D., S.M., M.B.A 17

SUMMARY

We found that that the overall provincial use of epidural analgesia during labour was thirty percent of vaginal deliveries during the time period April 1, 1997 to March 31, 2000. The epidural analgesia rate for Alberta is similar to that of other industrialized countries. However, within Alberta, there exists a stark geographical division in the use of epidurals. The high rate (thirty-nine percent to forty-five percent of vaginal deliveries) of epidural analgesia use is predominately found in hospitals located in the two Alberta metropolitan health regions (Capital and Calgary) with decreasing frequencies in designated regional hospitals (ten percent of vaginal deliveries) and the lowest use in small, rural hospitals (three percent to four percent of vaginal deliveries). The importance of hospital geographic location is greater than other maternal and newborn influencing factors available from administrative databases (previous live births, newborn birth weight, newborn prematurity, newborn breech presentation, and maternal reproductive system comorbidity). The use of epidural analgesia in the larger, rural hospitals (nine percent of vaginal deliveries) and regional centers (ten percent of vaginal deliveries) was similar despite the difference in the physician that predominantly performs the service (anaesthesiologist or general practice). We conclude that organizational factors are influential in determining the use of epidural analgesia during labour for vaginal delivery.

INTRODUCTION

Anaesthesia care is not necessary for all women during labour [1]. Pain relief for labour may be effectively provided using a variety of techniques [2, 3]. The published medical literature supports using a local anaesthetic delivered by epidural in order to provide greater quality of pain relief compared to parenteral narcotics [1]. If appropriate physician and nursing staff are available, epidurals should be one of the analgesic options offered by every hospital providing delivery services [1].

The selected pain relief technique depends in part on patient centered factors including patient/physician preferences, the medical status of the patient, and the progress of labour. Hospital organizational factors may also play a significant role in obstetrical pain relief. Over the last decade, obstetrical services have become more concentrated with fewer small, rural hospitals providing care [4]. The use of epidural analgesia increases with the number of births occurring at the specific hospital site [5-7]. The influence of physician training (anaesthesiologist versus general practice) upon the use of epidurals is not well described.

In this study the use of epidurals for obstetrical labour in Alberta during the years 1997 to 2000 is described using administrative databases. The influence of hospital organizational factors (physician specialty providing the service, and number of yearly deliveries per hospital) upon the use of epidurals is explored.

METHODS

Four administrative health service databases were used.

1. Canadian Institute for Health Information's (CIHI) Inpatient Discharge Abstract Database (DAD) for the province of Alberta for 1997/98 to 1999/00,
2. Alberta Physician Claims Assessment System Database for 1997/98 to 1999/00,
3. Alberta Vital Statistics Birth Database for 1997 to 1999, and
4. Alberta Health Insurance Plan Registry File for 1997 to 2000.

All data is maintained by Alberta Health and Wellness and the work was done in conjunction with a larger study being carried out by the Alberta Centre for Health Services Utilization Research.

In the last three calendar years for which we have information (1997, 1998, and 1999) about three hundred births (189, 285, 308 respectively) took place at home. In 1999, less than one percent of all births were at home. In 1999, about fifty percent (156) of these at home births were attended by a midwife and twenty-five percent (78) were attended by a physician.

Maternal deliveries were identified using CIHI (Canadian Institute for Health Information) DAD (Discharge Abstract Database). Over 99 percent of births that occur in Alberta every year take place in acute care facilities. All hospital discharges with main patient service area 51 (obstetrics delivered) for 1997/98, 1998/99 and 1999/00 were extracted for the last available three fiscal years. The decision to combine three years of data was made because the volume of deliveries in some facilities was small. No stillbirths were included.

The use of forceps or vacuum for delivery (ICD-9-CM 72.0, 72.1, 72.2x, 72.3x, 72.4, 72.5x, 72.6, 72.71, 72.79, 73.3) was extracted in any of the ten CIHI DAD procedural codes fields. Medical and surgical induction (ICD-9-CM 73.4, 73.01, 73.09) was extracted in any of the ten CIHI DAD procedural codes fields. Maternal reproductive comorbidity associated with pregnancy was defined as multiple pregnancy, malposition or malpresentation, abnormalities of cervix or uterus, and cephalopelvic disproportion (ICD-9-CM 651.x to 654.x in any of the 15 CIHI DAD diagnosis fields or as the Case Mix Grouper (CMG®) groupers 602, 603, 608, or 610 for previous cesarean sections). Fetal co-existing diagnosis associated with pregnancy was defined as developmental problems, fetal placenta or uterine problem (ICD-9-CM 655.x to 658.x in any of the 15 CIHI DAD diagnosis fields and not a maternal comorbidity as defined above). Maternal hypertension comorbidity was defined as ICD-9-CM 401.x to 405.x and 642.x in any of the 15 CIHI DAD diagnosis fields.

To obtain neonatal data (sex, birth weight, date and time of birth), main patient service area 54 (newborn) was extracted from CIHI DAD for 1997/98, 1998/99 or 1999/00. Using the Alberta Health Care Insurance Plan registry file group contract variable allowed matching each neonate to each delivering mother. Average length of stay (ALOS) after delivery for the mothers was calculated using the neonatal admission time and date and the maternal discharge time and date.

Birth records for each delivery were obtained. Vital statistic birth records contained questions to be completed by the family physician or pediatrician within twenty-four hours of delivery and by the mother. The vital statistic database did not record patients' unique Alberta Health Insurance Registry number. A deterministic linkage to maternal records for each of the three years was done by algorithm matching to neonatal birth date (365 unique values), birth weight (3,007 unique values), delivery site (87 facilities), neonatal sex, and maternal age (39 unique values). Records from vital statistics were collated by calendar year whereas all other administrative data was collated by fiscal year (April 1 to March 31). Vital statistics data from January 1, 2000 to March 31, 2000 were unavailable. Variables unique to vital statistics were number of total maternal live births, breech or cephalic presentation, neonatal Apgars at one, five, and ten minutes, and gestational weeks.

Physician claims were extracted for identified maternal deliveries using the Canadian Classification of Procedures (CCPx) code. The anonymous maternal identifier for delivery hospital discharges was used to identify specific billing records for these same mothers from physician claims. To account for time between the service date and a claim for reimbursement, all physician claims for at least six months after the delivery date were queried. These billing records included a range of anaesthesia services including epidural (CPX 16.91C) for obstetrical procedures, the role of the provider (anaesthesia), and the specialty of the provider (general practice, anaesthesiologist). The absence of an anaesthetic claim for a vaginal delivery was verified using the in-hospital CIHI record in which the anaesthetic type (none, epidural and spinal, general) is linked to the ICD-9-CM procedural code for vaginal delivery.

Defining facility size and service region

Hospitals providing maternal delivery services were categorized into six groups on the basis of the average number of deliveries per year over the three year study period, metropolitan location, and level of newborn facilities: 1) small rural hospitals (1 to 49 deliveries per year comprising 29 hospitals); 2) medium rural hospitals (50 to 99 deliveries per year comprising 13 hospitals); 3) large rural hospitals (100 to 405 deliveries per year comprising 32 hospitals); 4) regional hospitals (631 to 1691 deliveries per year comprising 5 hospitals located in one of the five non-metropolitan regional health care cities; 5) metropolitan (5 hospitals located in the metropolitan health regions of Calgary and Capital hospitals); 6) metropolitan-NICU 2 hospitals containing level three neonatal intensive care units (one hospital in each metropolitan center).

Statistics

Statistical modelling was done by forward stepwise logistic regression. The order of factor entry into the model was used to rank the magnitude of factor influence. The number of cases included in the models varies, as data for each influencing factor was not available for all deliveries. Significance was defined as $p < 0.05$.

Models included the following influencing factor

Dependent variable: use of epidural (yes, no) for vaginal delivery.
Influencing factors: facility group as defined above, pre-term (less than 37 weeks), low birth weight (less than 2,500 grams), breech delivery, cephalic delivery, previous live births, any maternal comorbidity.

RESULTS

There were 90,991 vaginal deliveries in Alberta during April 1,1997 to March 31, 2000. Data from vital statistics was unavailable between January 1, 2000 to March 31, 2000 so that 7,197 deliveries were not available for matching. Of the remaining 83,794 deliveries 67,181 (eighty percent) were matched to the vital statistics database and available for modeling using variables obtained from this source.

Table 1 illustrates the relationship between facility size (i.e. number of deliveries performed at each hospital site) and the use of epidural analgesia during labour for vaginal delivery. As shown in Table 2 epidural analgesia was performed by a large number of anaesthesiologists and general practitioners. All physicians who submitted a claim for at least one epidural procedure during a vaginal delivery at any time during the three-year period were included (Table 2). The median number of claims for epidurals is ten-fold greater for physicians who bill as anaesthesiologists as compared to general practice. The median number of epidural procedures for vaginal delivery claimed by general practitioners is less than four per annum and the corresponding number for anaesthesiologists is thirty-three.

Table 3 illustrates the relationship between facility size and the type of physician submitting a claim for an epidural procedure during vaginal delivery. Most epidural procedures for vaginal delivery are provided by general practice physicians in rural hospitals (i.e. hospitals that performed up to 405 deliveries during the three year period). Anaesthesiologists

provide most epidurals for vaginal deliveries in regional and metropolitan area hospitals. The epidural rate for vaginal deliveries is similar in large rural and regional hospitals (nine percent and ten percent respectively) despite the fact that the majority of procedures are performed by general practice (ninety-three percent) in large rural hospitals and by anaesthesiologist specialists in regional hospitals (seventy-two percent). The median number of epidural procedures claimed by individual general practice physicians is greater than that for individual anaesthesiologists in rural and regional hospitals. Only in metropolitan hospitals do individual anaesthesiologists perform a higher number of epidural procedures for vaginal delivery.

Table 4 illustrates the effect of facility size upon the use of epidural procedures for vaginal delivery after controlling for other influencing factors. The odds of receiving epidural analgesia during labour for vaginal delivery increases from three times to twenty-five times as the size of the facility increase. The order of entry into the model and the listing of variables indicates the relative strength of the influencing factors. Again facility size has the greatest influence when compared to other maternal factors such as first live birth or reproductive system comorbidity.

DISCUSSION

The availability of choice concerning labour analgesia and an increased demand for epidural analgesia in urban centers has resulted in an inequitable distribution in the province of Alberta. The greater demand for epidural anaesthesia since its introduction thirty years ago may be due to both physicians and health organizations being lobbied by a population with higher expectations of pain relief as well as familiarity and improvements with the procedure. The history of obstetrical anaesthesia has historically been one of the medical community lagging behind mothers' demands [8]. The rate of epidural anaesthesia has been previously shown to be lower in rural hospitals [5, 9]. For example, the rate of epidurals in one rural hospital in Saskatchewan with 1,224 deliveries between 1984 to 1988 was 4.6 percent during labour for vaginal deliveries [9]. We attempted to simultaneously assess the effect of patient factors that may alter the use of epidurals along with the facility size. We found that previous births, reproductive system comorbidity, prematurity, and low birth weight were less influential than small facility size in the use of epidurals.

A high epidural use may be considered beneficial as it affords superior obstetrical pain relief [10]. Opposing the desirability of greater epidural use is

the generally unwanted connotation that childbirth is being medicalized. As well, epidurals have significant risks. If increasing the use of epidurals is the desired goal, then a number of factors need to be considered. Continuous infusion of low dose epidural analgesia negates the need for physicians to stay and watch. Physician reimbursement for epidurals has been demonstrated to be one factor in determining use [10]. In the United States [19], insurance companies have tried to deny epidural analgesia on the basis of increased costs. The number of rural Ontario hospitals providing epidurals decreased between 1988 to 1995 [4] similar to the United States trend of fewer small, rural hospitals performing deliveries [18]. In absence of an enabling organization (greater number of hospital deliveries, local champion), resources required to facilitate epidural analgesia are unlikely to be provided. As a result, patients may choose to labour in a hospital other that geographically closest. Travelling distances to metropolitan hospitals are within a few hours for the majority of the Alberta population. In Alberta, twenty percent of singleton vaginal deliveries for newborns weighing at least 2,500 grams bypass their nearest facility that performs deliveries [20]. The reasons for this bypass are unknown, but we can speculate that patients may desire services not locally available.

The number of epidural procedures performed by general practitioners is greater than for anaesthesiologists in smaller hospitals. In the largest rural hospitals, general practitioners provide epidurals as frequently as anaesthesiologists working in regional hospitals. We provide no new data on the advantages and disadvantages between specialist and non specialist performed epidurals. Nor do we make any inferences from our data concerning outcomes by high or low volume epidural provider. However, any organization attempting to increase its use of epidurals need not be constrained in only considering anaesthesiologists nor be assured that a high rate is ensured by the mere presence of anaesthesia specialists.

Our analysis divided hospitals into categories using the number of deliveries. However, within Alberta hospitals with similar delivery volumes, variation in the use of epidurals still existed. Most striking in Alberta is that one of the highest use of epidurals is in a medium-sized rural hospital [22] staffed by two general practice anaesthesiologists. This high rate compared favourably to both other similar-sized hospitals and even the largest metropolitan hospitals with a dedicated epidural service. A survey of Alberta hospitals that provided delivery services in 1994 reported that maternity units with high epidural rates had developed a consensus among all clinicians that epidural anaesthesia was an important and helpful method of pain relief [22]. In maternity units with lower epidural rates, this consensus did not exist. These lower rate maternity units also reported that their patients would not

take advantage of the epidural service. However, both patients and physicians related that pain issues were only discussed in relation to direct patient questions [22]. Our data does not describe the range of complex organization factors that may result in differing epidural rates among Alberta hospitals.

LIMITATIONS

Population-based administrative database research is highly generalizable although limited in clinical detail. We were able to verify both deliveries and performance of epidural procedures by comparing two independent databases. We are reliant on those completing other data fields for non-verifiable data. Anaesthesiologist specialist or general practitioner identification relate to Alberta College of Physician and Surgeons' classification. General practitioners may have specialist training not recognized by the Alberta College of Physician and Surgeons. The link to the vital statistics data base captured eighty percent of cases. We did not detect a systematic bias between matched and non-matched cases however this possibility still exists.

Table 1 – Number and Percent of Deliveries in Which the Patient Received *Epidural Anaesthesia by Facility Type during 1997/98-1999/00*

Facility	Hospitals	Epidural During Labour For Vaginal Delivery		
Type	**Number**	**# Epidurals**	**# Deliveries**	**% Deliveries with an Epidural**
Small rural (< 50)	12	45	1,761	2.6%
Medium rural (50 – 99)	12	92	2,319	4.0%
Large rural (100 – 405)	30	1,285	14,007	9.0%
Regional (631 – 1,691)	5	1,474	14,308	10.0%
Metropolitan (Calgary or Edmonton)	5	14,875	37,667	39.0%
Metropolitan-NICU (Calgary or Edmonton)	2	9,363	20,929	45.0%
Alberta total	**66**	**27,134**	**90,991**	**30.0%**

Note total epidurals vary as not all categories are complete.

Table 2 – Volume of Epidural Anaesthesia by Physician Group During 1997/98-1999/00 for Vaginal Deliveries During Labour

			Volume of Epidurals Provided		
Type of Physician	# of Epidurals	# of Physicians Providing Epidurals	1st Quartile	Median	3rd Quartile
Anaesthesiologist	23,722	188	21	99	189
General Practice	3,362	95	3	11	26

Note total epidurals vary, as not all categories are complete.

Table 3 – Number of Epidurals During Labour for Vaginal Delivery by Facility and Provider Type During 1997/98-1999/00

Hospital facility Size	Rural – small <50	Rural – medium 50-99	Rural – large 100-405	Regional 631-1,691	Metropolitan Calgary or Edmonton	Metropolitan Calgary or Edmonton with NICU
Epidural procedures by anaesthesiologist	8	12	92	1,056	13,285	9,268
Epidural procedures by general practice	44	81	1,208	411	1,604	15
Median number of epidurals (quartiles) for anaesthesiologist	1 (1, 1)	1 (1, 1)	1 (1, 2)	1.5 (1,14.5)	34 (6, 164)	15 (2,123)
Median number of epidurals (quartiles) for general practice	2 (1, 12)	8 (1, 10)	8 (2, 17)	2 (1, 18)	6 (1, 65)	1 (1, 1)

Note total epidurals vary, as not all categories are complete.

Table 4 – Modeling the Use of Epidurals During Labour for Vaginal Delivery by Facility Size Controlling for Other Influencing Factors

Influencing factors Model n=67,539	Number for each influencing factor	Odds ratio and 95% Confidence Interval
Hospital size rural - medium 100 - 405	11,086	3.01 (2.22 - 4.08)
Hospital size regional 631 - 1,691	11,779	3.19 (2.36 - 4.31)
First live birth	26,613	3.01 (2.90 - 3.12)
Maternal reproductive system comorbidity	6,261	2.33 (2.19 - 2.48)
Hospital size metropolitan Calgary or Edmonton with NICU	17,248	25.64 (19.05 - 34.51)
Hospital size metropolitan Calgary or Edmonton	24,232	21.25 (15.79 - 28.58)
Gestation < 37 weeks	3,718	0.79 (0.72 - 0.86)
Birth weight < 2,500 grams	2,694	0.77 (0.70 - 0 .86)
Breech delivery	631	0.79 (0.65 - 0.95)

Note rank order listing of influencing factors indicates relative influence.
Note total epidurals vary, as not all categories are complete.

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APPENDIX

Table: Epidurals During Labour for Vaginal Deliveries in Alberta Regional Health Authorities During April 1, 1997 to March 31, 2000 by Location Of Service

Service Regional Health Authority	Number of epidurals	Number of vaginal deliveries	Rate of epidural use
1	749	5,219	14%
2	48	3,239	1%
3	151	1,355	11%
4	12,749	29,536	43%
5	61	906	7%
6	239	5,454	4%
7	192	1,912	10%
8	484	1,139	42%
9	70	1,641	4%
10	11,364	29,060	39%
11	112	1,397	8%
12	141	2,660	5%
13	82	3,177	3%
14	26	775	3%
15	15	913	2%
16	503	1,484	34%
17	5	1,126	0%
Province	**26,991**	**90,993**	**30%**

Note that a designated service regional health authority is not available for all epidurals

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In her position with Alberta Health and Wellness, Dr. Corrine Truman is involved in coordinating and conducting utilization review and analysis activities at the both the provincial and regional level.

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As a demographer, Yan Jin is interested in applying demographic and statistical techniques in health field, particularly in population health and health service utilization. He taught demographic techniques at the University of Alberta.

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As a physician, Dr. Johnson's clinical practice is affected by the health care system. Dr. Johnson is interested in understanding and promoting the use of information in directing health policy formation and decision making by the managers of the health care system.

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